FIG.1

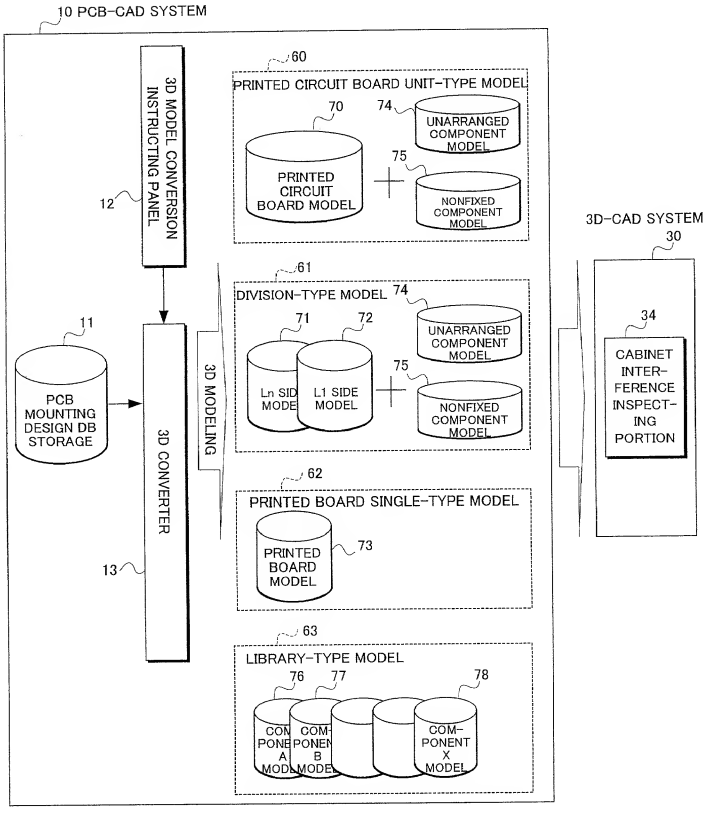

10 PCB-CAD SYSTEM
3D MODEL CONVERSION INSTRUCTING PANEL
12
60
PRINTED CIRCUIT BOARD UNIT-TYPE MODEL
70
74
UNARRANGED COMPONENT MODEL
PRINTED CIRCUIT BOARD MODEL
75
NONFIXED COMPONENT MODEL
3D-CAD SYSTEM
30
61
DIVISION-TYPE MODEL
74
34
11
71
72
UNARRANGED COMPONENT MODEL
CABINET INTER-FERENCE INSPECT-ING PORTION
PCB MOUNTING DESIGN DB STORAGE
3D CONVERTER
3D MODELING
Ln SID MODE
L1 SIDE MODEL
75
NONFIXED COMPONENT MODEL
62
PRINTED BOARD SINGLE-TYPE MODEL
PRINTED BOARD MODEL
73
13
63
LIBRARY-TYPE MODEL
76
77
78
COM-PONENT A MODEL
COM-PONENT B MODEL
COM-PONENT X MODEL

FIG.2A		FIG.2B	FIG.2C
COMPONENT NAME	I1	E1	Q1
COMPONENT SPECIFICATION	P-SPEC1	E-SPEC	Q-SPEC
COMPONENT CLASSIFICATION	ELECTRIC COMPONENT	MECHANICAL COMPONENT	PSEUDO COMPONENT
SMD/IMD CLASSIFICATION	SMD	IMD	SMD
COMPONENT HEIGHT	2.0mm	5.0mm	0.0mm
FIXING FLAG	NONFIXED	FIXED	FIXED
ARRANGEMENT FLAG	ARRANGED	ARRANGED	ARRANGED
ARRANGED SIDE	Ln	Ln	Ln
ARRANGED COORDINATES	(10,10)	(100,10)	(50,50)
NUMBER OF COMPONENT PINS	8	0	1
COMPONENT SHAPE ELEMENT			

FIG.2D		FIG.2E	FIG.2F
COMPONENT NAME	I2	E2	I3
COMPONENT SPECIFICATION	P-SPEC	E-SPEC	Q-SPEC
COMPONENT CLASSIFICATION	ELECTRIC COMPONENT	MECHANICAL COMPONENT	ELECTRIC COMPONENT
SMD/IMD CLASSIFICATION	SMD	IMD	SMD
COMPONENT HEIGHT	2.0mm	5.0mm	2.0mm
FIXING FLAG	NONFIXED	FIXED	NONFIXED
ARRANGEMENT FLAG	UNARRANGED	ARRANGED	ARRANGED
ARRANGED SIDE	—	Ln	L1
ARRANGED COORDINATES	—	(100,10)	(50,50)
NUMBER OF COMPONENT PINS	8	0	8
COMPONENT SHAPE ELEMENT			

FIG.3

COMPONENT NAME	PRINTED BOARD 51
COMPONENT SPECIFICATION NAME	BOARD-SPEC
COMPONENT THICKNESS	10.0mm
COMPONENT SHAPE ELEMENT	

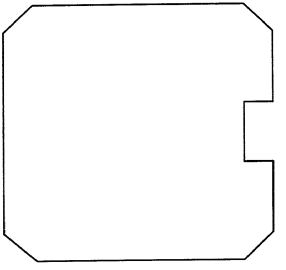


FIG.4

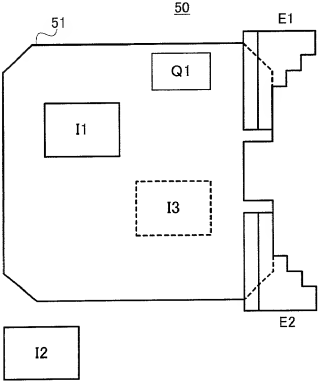


FIG.5

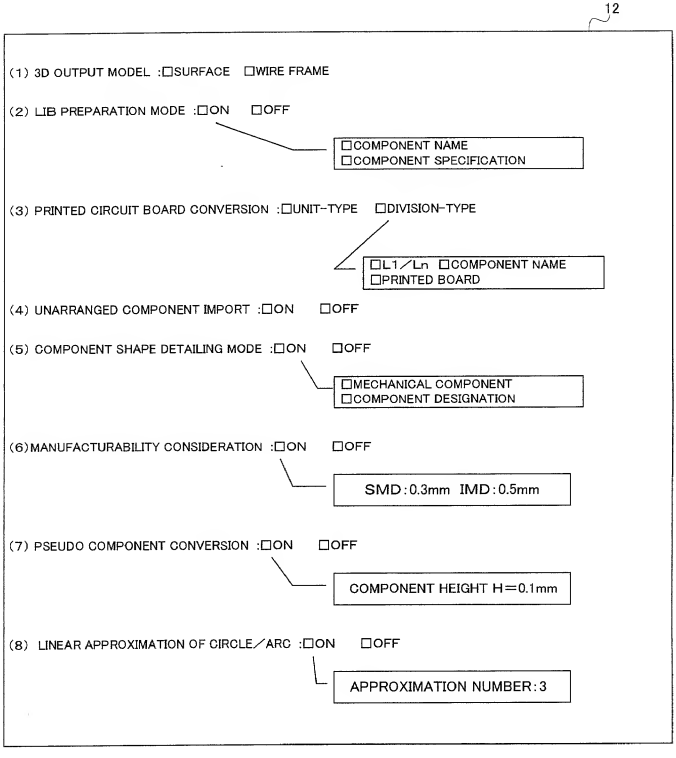

12
(1) 3D OUTPUT MODEL :□SURFACE □WIRE FRAME
(2) LIB PREPARATION MODE :□ON □OFF
□COMPONENT NAME
□COMPONENT SPECIFICATION
(3) PRINTED CIRCUIT BOARD CONVERSION :□UNIT-TYPE □DIVISION-TYPE
□L1/Ln □COMPONENT NAME
□PRINTED BOARD
(4) UNARRANGED COMPONENT IMPORT :□ON □OFF
(5) COMPONENT SHAPE DETAILING MODE :□ON □OFF
□MECHANICAL COMPONENT
□COMPONENT DESIGNATION
(6)MANUFACTURABILITY CONSIDERATION :□ON □OFF
SMD:0.3mm IMD:0.5mm
(7) PSEUDO COMPONENT CONVERSION :□ON □OFF
COMPONENT HEIGHT H=0.1mm
(8) LINEAR APPROXIMATION OF CIRCLE/ARC :□ON □OFF
APPROXIMATION NUMBER:3

FIG.6

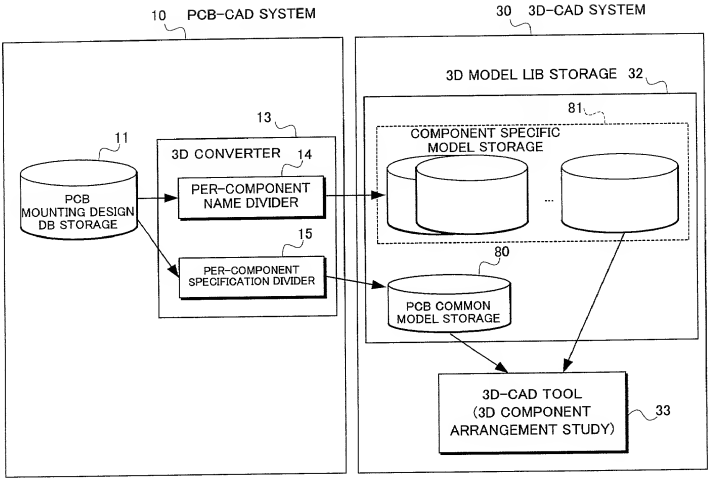

10 PCB-CAD SYSTEM
30 3D-CAD SYSTEM
3D MODEL LIB STORAGE 32
81
COMPONENT SPECIFIC MODEL STORAGE
...
13
11
3D CONVERTER
14
PCB MOUNTING DESIGN DB STORAGE
PER-COMPONENT NAME DIVIDER
15
PER-COMPONENT SPECIFICATION DIVIDER
80
PCB COMMON MODEL STORAGE
3D-CAD TOOL (3D COMPONENT ARRANGEMENT STUDY)
33

FIG.7

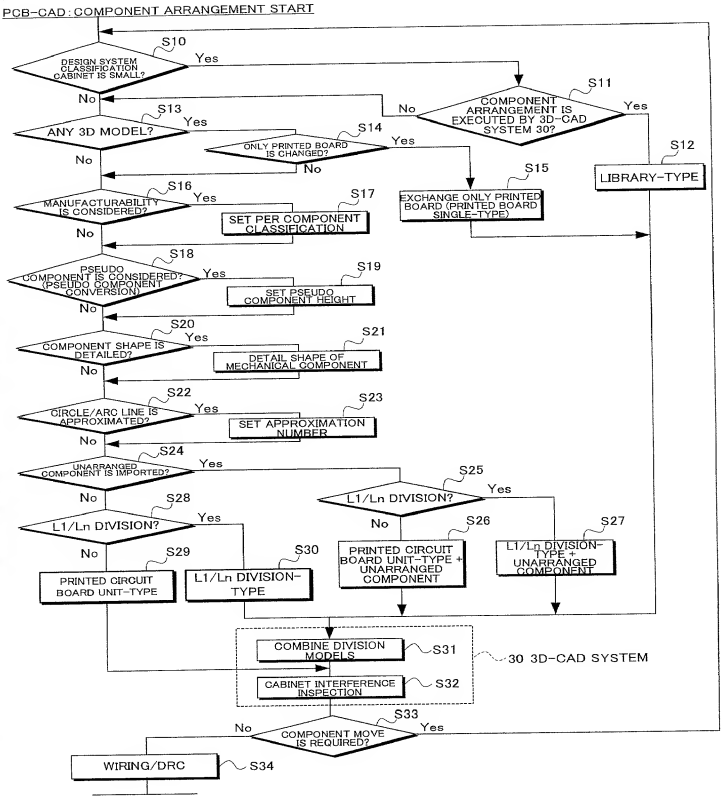
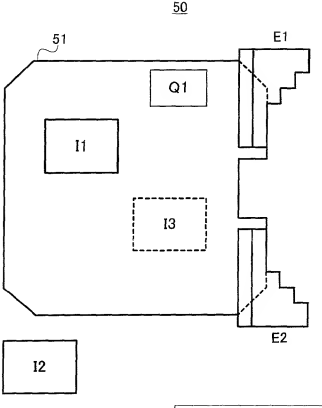

PCB-CAD:COMPONENT ARRANGEMENT START
S10
DESIGN SYSTEM CLASSIFICATION CABINET IS SMALL?
Yes
No
S11
COMPONENT ARRANGEMENT IS EXECUTED BY 3D-CAD SYSTEM 30?
Yes
No
S12
LIBRARY-TYPE
S13
ANY 3D MODEL?
Yes
No
S14
ONLY PRINTED BOARD IS CHANGED?
Yes
No
S15
EXCHANGE ONLY PRINTED BOARD (PRINTED BOARD SINGLE-TYPE)
S16
MANUFACTURABILITY IS CONSIDERED?
Yes
No
S17
SET PER COMPONENT CLASSIFICATION
S18
PSEUDO COMPONENT IS CONSIDERED? (PSEUDO COMPONENT CONVERSION)
Yes
No
S19
SET PSEUDO COMPONENT HEIGHT
S20
COMPONENT SHAPE IS DETAILED?
Yes
No
S21
DETAIL SHAPE OF MECHANICAL COMPONENT
S22
CIRCLE/ARC LINE IS APPROXIMATED?
Yes
No
S23
SET APPROXIMATION NUMBER
S24
UNARRANGED COMPONENT IS IMPORTED?
Yes
No
S25
L1/Ln DIVISION?
Yes
No
S26
PRINTED CIRCUIT BOARD UNIT-TYPE + UNARRANGED COMPONENT
S27
L1/Ln DIVISION-TYPE + UNARRANGED COMPONENT
S28
L1/Ln DIVISION?
Yes
No
S29
PRINTED CIRCUIT BOARD UNIT-TYPE
S30
L1/Ln DIVISION-TYPE
COMBINE DIVISION MODELS
S31
30 3D-CAD SYSTEM
CABINET INTERFERENCE INSPECTION
S32
S33
COMPONENT MOVE IS REQUIRED?
No
Yes
WIRING/DRC
S34

FIG.8A



3D MODELING FOR TWO COMPONENTS

FIG.8B

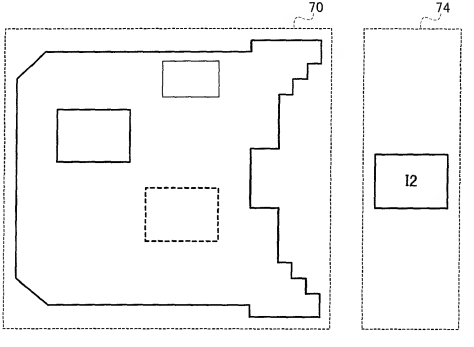


FIG.9A

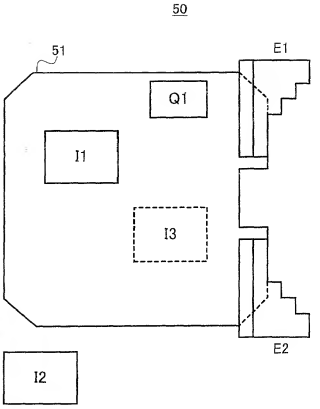

50
51
E1
Q1
I1
I3
E2
I2
3D MODELING FOR
THREE COMPONENTS

FIG.9B

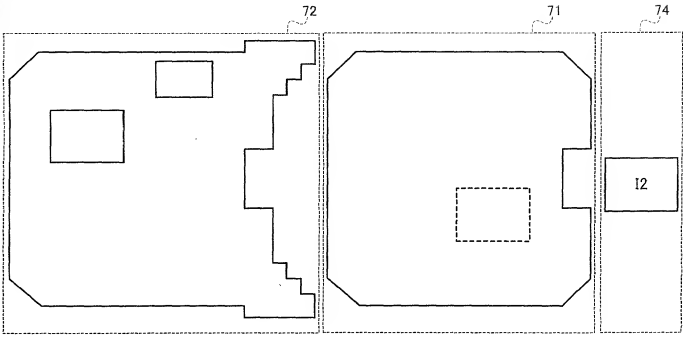

72
71
74
I2

FIG.10A

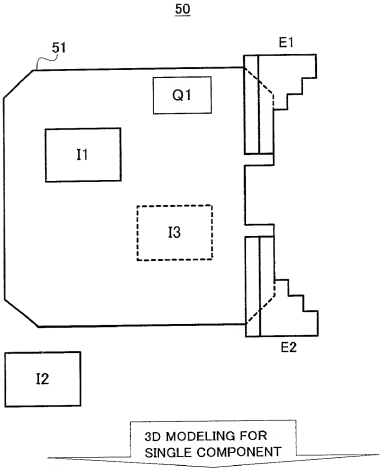


FIG.10B

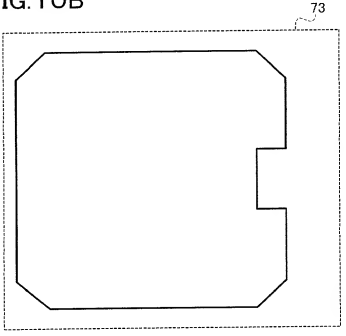
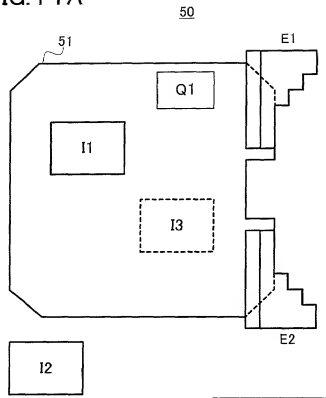


FIG.11A



3D MODELING FOR SEVEN COMPONENTS

FIG.11B

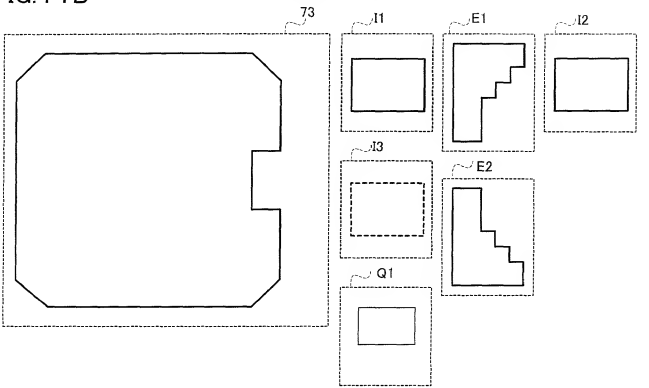


FIG.12

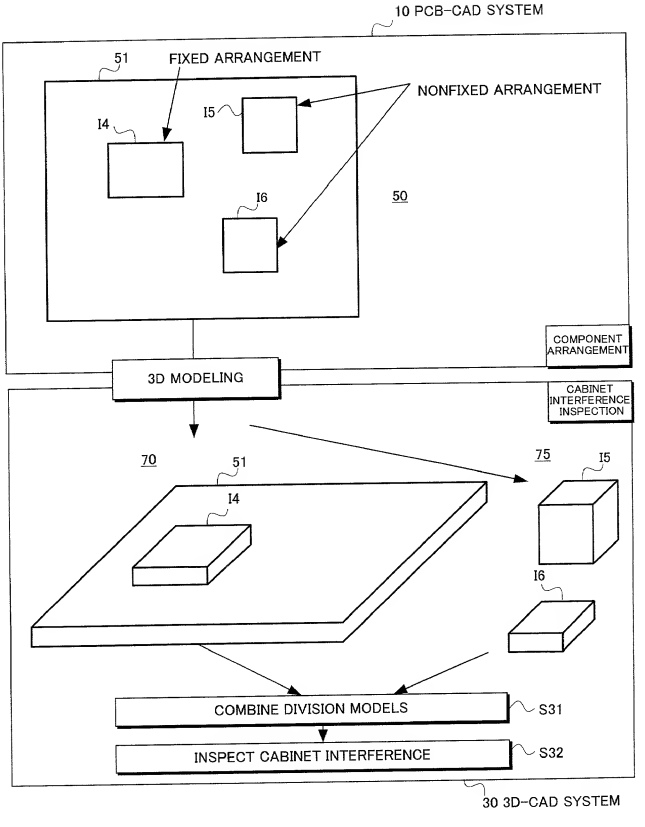

10 PCB-CAD SYSTEM
51
FIXED ARRANGEMENT
NONFIXED ARRANGEMENT
I4
I5
I6
50
COMPONENT ARRANGEMENT
3D MODELING
CABINET INTERFERENCE INSPECTION
70
51
75
I5
I4
I6
COMBINE DIVISION MODELS
S31
INSPECT CABINET INTERFERENCE
S32
30 3D-CAD SYSTEM

FIG.13A

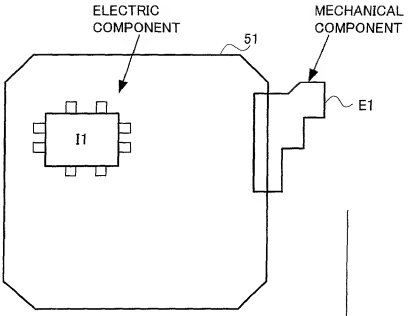
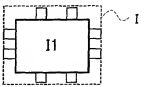


FIG.13B



3D CONVERSION BY ADDING HEIGHT

FIG.13C

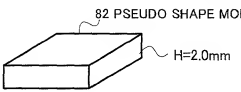
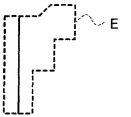


FIG.13D



3D CONVERSION BY ADDING HEIGHT

FIG.13E

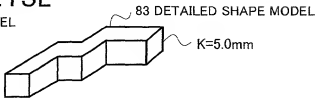


FIG.14

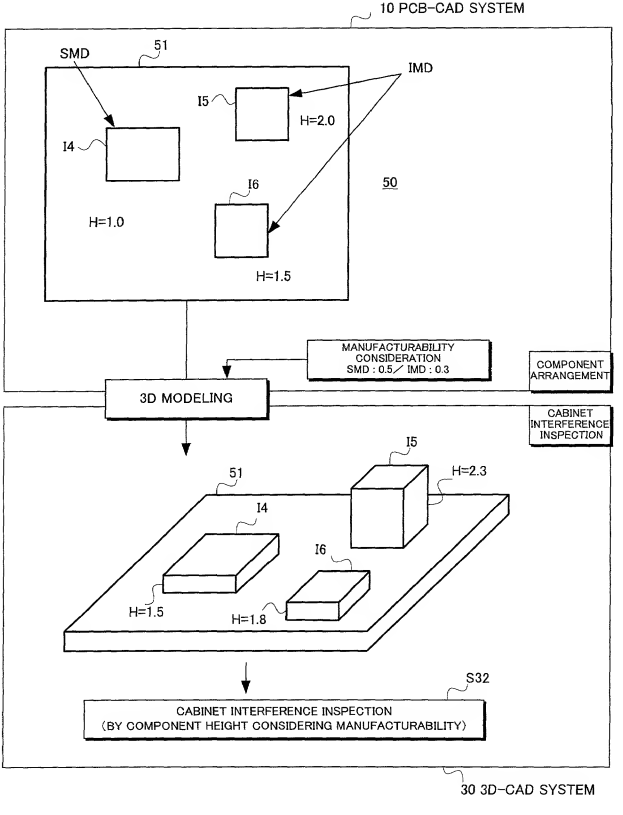

10 PCB-CAD SYSTEM
SMD
51
IMD
I5
H=2.0
I4
50
I6
H=1.0
H=1.5
MANUFACTURABILITY CONSIDERATION
SMD : 0.5, IMD : 0.3
COMPONENT ARRANGEMENT
3D MODELING
CABINET INTERFERENCE INSPECTION
I5
51
H=2.3
I4
I6
H=1.5
H=1.8
S32
CABINET INTERFERENCE INSPECTION
(BY COMPONENT HEIGHT CONSIDERING MANUFACTURABILITY)
30 3D-CAD SYSTEM

FIG.15

PRIOR ART

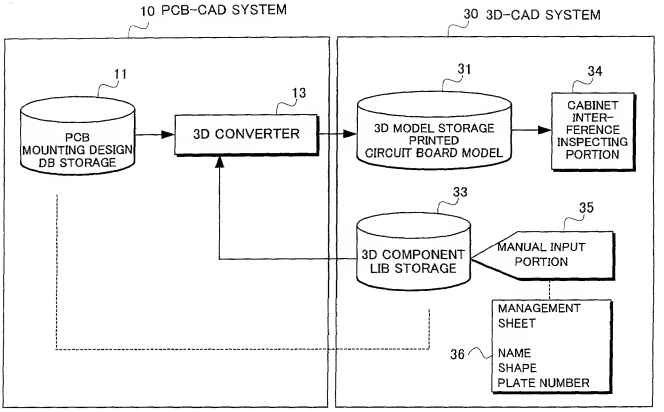


FIG.16

PRIOR ART

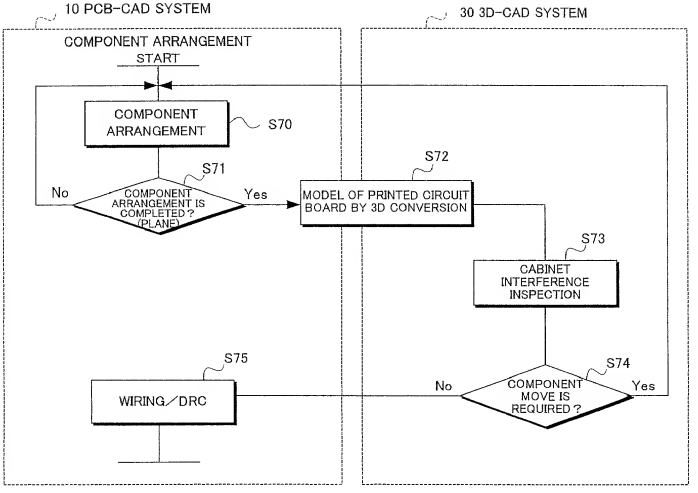


FIG.17
PRIOR ART

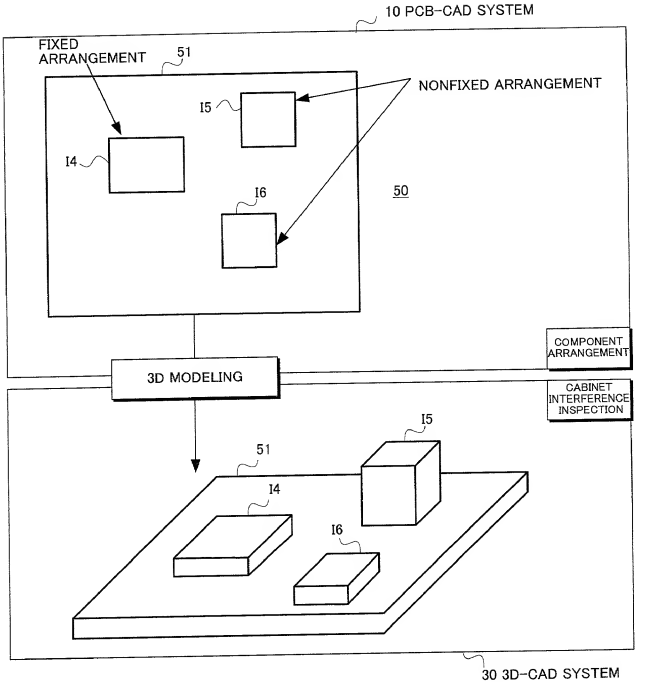
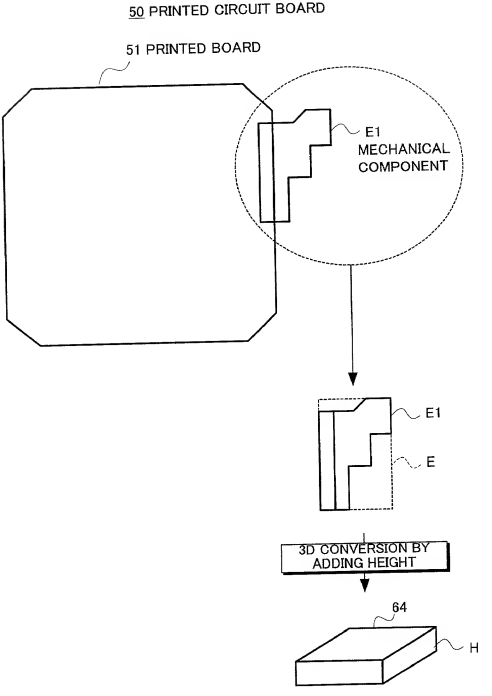


FIG.18

PRIOR ART